

the evening of the 24th over Minnesota. It passed thence southeastward to West Virginia by the 27th, when another high area was central over eastern Lake Superior. This latter became the main high and passed thence south-eastward to the south Atlantic States by the evening of the 29th. Frosts occurred quite generally in connection with these two highs over the upper Mississippi Valley, the Lake region, the northern portion of the Ohio Valley, and the Middle Atlantic, and New England States, warnings being successfully issued in the majority of cases. On the morning of the 29th low temperature records for the month of September were broken at three stations in Atlantic Coast States. Another offshoot from the Pacific high area was central on the north Pacific coast on the evening of the 27th, and moved thence eastward to the northern upper Lake region by the end of the month.

A low-pressure area that was over western Alberta on the 26th moved eastward along the northern border and was central at the last of the month off the New England coast. Very little precipitation attended its passage.

#### NORTHERN HEMISPHERE PRESSURE.

*Alaska.*—Pressure averaged decidedly above normal over the Aleutian Islands and slightly above normal over Bering Sea, as indicated by reports from Nome. Over southeastern Alaska pressure averaged below normal, while elsewhere pressure was about the seasonal average. Lows occurred about the 4th, 9th, 12th–13th, 21st, 25th–26th, and 28th; and highs about the 1st, 6th, 11th, 14th, 17th–18th, 24th, and 29th–30th. The most pronounced high of the month occurred about the 15th.

*Honolulu.*—Pressure averaged below normal, being almost continuously below from the 1st to the 26th and above from that time until the end of the month.

*Horta.*—Pressure averaged slightly above the normal. Lows occurred on the 2d–3d, 5th–6th, 17th, 23d–24th, and 27th–28th; and highs on the 1st, 8th–14th, and 19th–22d, the most important being the one that crested on the 12th.

#### FORECAST DISTRIBUTION.

By GEORGE W. SMITH.

[Dated, Forecast Division, Weather Bureau, Sept. 1, 1914.]

The daily distribution of weather forecasts by the Weather Bureau, Department of Agriculture, has attained such success, the forecasts and warnings are so popular and affect all affairs to such an extent, that a paper contrasting the small beginnings of this service with its present condition must prove interesting to a large number of readers. Mention of "cautionary" or storm signals and also of the Daily Weather Map will be made, but only in a casual way, as these should receive the separate consideration that their importance merits.

Storm studies had been begun by James P. Espy, who was appointed "Government meteorologist" in 1840. Espy died in 1860, but his work was continued by the Smithsonian Institution and later by the Cincinnati Observatory until 1870. The official collection of meteorological reports by telegraph was begun by the Signal Corps of the United States Army, under the Chief Signal Officer, Gen. Albert J. Myer, by authority of Congress, see "Public Resolution No. 9," approved February 9, 1870.

The first reports and bulletins of the Signal Office were for November 1, 1870, 7:35 a. m., 4:35 p. m., and 11:35 p. m.,

Washington time, at 24 selected stations of observation. The reports received from these stations were prepared in the form of tabulated bulletins, and these were given to the "press" three times a day at 10 a. m., 7 p. m., and 1 a. m., respectively. These reports were promptly plotted at Chicago, Ill., by Prof. I. A. Lapham, of Milwaukee, Wis., on charts for the purpose of studying the probable occurrence of storms on the Great Lakes. The first notice of an expected storm was sent by Prof. Lapham to Gen. Myer, and telegraphed by the latter officially from the central office at Washington, D. C., on November 8, 1870. It was telegraphed to several stations along the Lakes and bulletined for the benefit of shipping interests there.

These bulletins of the weather conditions early attracted considerable attention, and those particularly interested made a strong demand that "deductions" from the collected reports be made and published.

On January 3, 1871, the services of Prof. Cleveland Abbe, then of the Cincinnati Observatory, were secured, and since that date he has been continuously identified with the weather service of the United States. The compilation of maps, "synopses," and "probabilities" was begun by him at once. The former showed the weather conditions at the hours of observation, and the latter showed deductions made from the telegraphic reports as to probable weather conditions for the ensuing eight hours.

The first published forecasts of the weather were issued on February 19, 1871; these received commendation at first, but afterwards severe criticism because the public expected unreasonable verification of the predictions. As the public became better acquainted with published "probabilities" it demanded that reporting stations be established in the interior of the country at points not previously represented and that predictions be made for the interior sections of the country, and for the benefit of river navigation and the agricultural interests. Accordingly, under an act of Congress approved June 20, 1872, the Secretary of War was directed to provide such stations, signals, and reports as might be found necessary for the benefit of agricultural and commercial interests throughout the United States. This considerably extended the scope of the work of the service.

Up to May 1, 1871, the maps and bulletins were prepared by manifold process, but on that date successful lithographic printing of the maps was begun. This lithographic weather map was favorably received and even became popular; before long it led to the publication, under the direction of the central office at Washington, D. C., of similar charts at New York, N. Y., Philadelphia, Pa., Cincinnati, Ohio, Chicago, Ill., and New Orleans, La. The press bulletins were also prepared three times a day, and contained, first, the "synopses"; second, the "probabilities"; third, the "special storm warnings" when ordered. The number of weather maps and tabular bulletins issued at Washington, D. C., in 1871 averaged 35 of the former and 60 of the latter, daily.

The "synopses" and "probabilities" were given to the public as promptly as possible. The contents of the bulletin were telegraphed to the several stations and there posted. Arrangements were made for the display of "cautionary" or storm signals at 24 stations. These stations have been gradually multiplied until they number 369 at present [1914]. A signal flag was early adopted to indicate "cautionary" or storm warnings. It was a square red flag with a square black center (see fig. 13),

and was first officially displayed at Oswego, N. Y., on October 26, 1871. About that same time it was also displayed on the North Carolina coast.

The increased demand for the predictions caused the Secretary of War to request the cooperation of the Post Office Department in the dissemination of the weather bulletins. The scheme was approved June 8, 1872. The Postmaster General offered hearty cooperation with the Signal Corps of the Army, and on December 9, 1872, instructed postmasters to lend their aid by specially speedy forwarding of the mailed bulletins, and by posting the reports in conspicuous places in their offices. The Post Office bulletin began June 15, 1873. A publication was thereafter issued under the title "Post Office Bulletin," and this bulletin was prepared at 15 central or distributing stations, to which stations the synopses and probabilities were telegraphed from Washington, D. C. In this way two copies of the bulletin were sent to every post office within the zones of these stations that could be reached before 4 p. m. of the afternoon of the day that the bulletin was issued, reaching 4,391 post offices. The total issue for the year ending November 1, 1873, was 895,014, and of the weather map 320,770, a grand total of 1,215,784 during the year. The printing of the Post Office Bulletin was begun at Washington on January 14, 1873. Previously the publication had been manifolded. The "press" was always ready to print weather bulletins and reports as news, and thus the information secured a wider distribution than appears in the above figures.

As usual in new ventures, many difficulties were met, but the hearts of those engaged were in the work, and as obstacles presented they were overcome as far as the funds available would allow.

With experience, the accuracy of the "probabilities," so called, improved from 69 per cent verified the first year to 84 per cent verified in 1874.

So great was the demand for these weather reports that in January, 1874, arrangements were perfected for the printing of the bulletins at several stations outside of Washington. In this year also the title of the "Post Office Bulletin" was changed to "Farmers' Bulletin," and its edition and distribution increased. The bulletin at this time was received at 6,364 post offices throughout the country. There were 20 central or distributing stations from which they were sent out. The midnight reports continued to be the basis of the deductions of predictions that were printed and distributed.

It was through the hearty cooperation of the Post Office Department that so many of the post offices in cities, towns, villages, and hamlets were reached and the information was made available to those engaged in agricultural pursuits. Most of the post offices received the 9 a. m. bulletins as early as 2 p. m. of the same day.

In 1875 some railroad companies saw the usefulness of "probabilities" in connection with the operation of their roads, and began sending the information to their stations by railroad telegraph.

The term "probabilities," early given to the forecasts, was changed to "indications" in 1876. The need of indications and weather reports for locations on the Pacific coast was manifested, and a station for the printing and distribution of indications was proposed for Sacramento, Cal.

The division of the country into districts, as then used, was as follows: New England, Middle States, South Atlantic States, eastern Gulf States, western Gulf States, lower Lakes, upper Lakes, Tennessee and Ohio Valleys, upper Mississippi Valley, and lower Missouri Valley.

The preparation of indications for the Pacific Coast States began in February, 1879 (although a successful prediction of a storm was made in April, 1871), and that region was divided into three districts, viz, northern Pacific, central Pacific, and southern Pacific.

In 1879 an arrangement was made whereby the railroad companies were provided with the "synopses" and "indications" in the form of a "railroad bulletin" to be posted in their local stations. There were 36 railroads cooperating in this way, and the bulletin posted at 1,212 stations. The number of railroad companies thus cooperating with the Signal Service was increased to 95 in 1880, and the number of stations served in this way was 2,889.

The need was felt for further subdivision of the western country into regions or districts in connection with weather "indications," and accordingly in 1881 the following subdivisions were adopted for the purposes of the weather service: Extreme Northwest, Northern Slope, Middle Slope, Southern Slope, Northern Plateau, Middle Plateau, and Southern Plateau.

In 1881, for the first time, special bulletins were prepared for the press containing meteorological information of popular interest. They treated especially of high winds, severe storms, heavy rainfall, frost, sudden and extreme changes in temperature, and predictions of fair and rainy weather for two days in advance, made when conditions seemed to warrant, for the benefit of health resorts during the season when they were most frequented.

In November, 1879, special frost indications were ordered prepared and telegraphed to New Orleans for distribution for the benefit of the sugar interests. This information was given out by the press; by bulletins at cotton exchanges, sent over the city by telephone; telegraphed to towns and parishes; and where no other facilities were available it was sent by mail. The first indications proving a success, similar frost warnings for the benefit of the orange interests in Florida and of the fruit interests in other sections were begun in 1881 for the first time. In the fall of 1882 the system of "special frost warnings" was extended to benefit tobacco interests. A "system of warnings for northerners" in the southwestern section of the country and Texas was in operation. Fourteen railroad companies whose lines passed through the section assisted in disseminating the information.

The first symbols to designate the probable weather conditions were used by the Cleveland, Akron, & Columbus Railway, which inaugurated a scheme for placing symbols on their baggage cars. The symbols adopted were:

Solid red disk.....to indicate higher temperature.  
Solid red crescent.....to indicate lower temperature.  
Solid red star.....to indicate stationary temperature.  
Solid blue disk.....to indicate general rain or snow.  
Solid blue crescent.....to indicate clear or fair weather.  
Solid blue star.....to indicate local rain or snow.

These were of sheet iron about 3 feet in diameter with the symbol painted thereon.

This system of disseminating weather information was operated by sending the indications by telegraph to a "middle" station, where the proper symbols were placed on baggage cars at 5 o'clock a. m.

It was through the efforts of Prof. T. C. Mendenhall, of the Ohio meteorological service, that the symbol scheme was first put into practical use.

Flags [see also above, p. 541] as a means for furnishing information as to the probable weather conditions were also employed in 1884 by the Alabama State Weather

Service cooperating with the United States Signal Service, and the scheme consisted of a set of three flags, white, yellow, and blue, giving nine combinations as follows:

|             |       |   |
|-------------|-------|---|
| White       | ..... | indicating fair weather and lower temperature       |
| White over  | ..... | indicating fair weather and higher temperature.     |
| Yellow      | ..... | indicating fair weather and stationary temperature. |
| White over  | ..... | indicating fair weather and stationary temperature. |
| Blue        | ..... | indicating local rains and higher temperature.      |
| Yellow over | ..... | indicating local rains and stationary temperature.  |
| Blue        | ..... | indicating local rains and lower temperature.       |
| White over  | ..... | indicating local rains and lower temperature.       |
| Blue        | ..... | indicating general rain and stationary temperature. |
| Blue over   | ..... | indicating general rain and lower temperature.      |
| White       | ..... | indicating general rain and lower temperature.      |
| Blue over   | ..... | indicating general rain and higher temperature.     |
| Yellow      | ..... | indicating general rain and higher temperature.     |

A flag adopted by the United States Signal Service to indicate an expected "cold wave" was white with a square black center (see fig. 5). The use of colored rockets or exploding cartridges for use at night in giving notice of expected weather conditions were successfully used at the Grange experiments at Williams Grove, Pa., during August 26 to 29, 1884. This scheme was not put into active general operation. During 1885 the dissemination of weather forecasts (indications) by means of flags was greatly extended. In Ohio flags similar to the symbols used on baggage cars were put in use. The flags were 6 feet square, and white, with the solid red disk, red crescent, red star, and blue disk, blue crescent, and blue star, respectively.

The United States Signal Service and the Alabama State Weather Service, later in 1884, agreed on the following flags:

|                              |                           |
|------------------------------|---------------------------|
| White (square).....          | to indicate fair.         |
| Orange (square).....         | to indicate local rain.   |
| Blue (square).....           | to indicate general rain. |
| Black (triangular).....      | to indicate temperature.  |
| White with black center..... | to indicate cold wave.    |

The five signals were actually employed by the Alabama State service; but the Federal Service still hesitated, and in fact never adopted the orange flag for local rains (see below, 1892).

Special consideration was given the adoption of a system of flags to indicate the weather and on March 1, 1887, the United States Signal Service adopted the following:

|                                     |                           |
|-------------------------------------|---------------------------|
| White (6 feet square).....          | indicated clear and fair. |
| Blue (6 feet square).....           | indicated rain or snow.   |
| Black (pennant).....                | indicated temperature.    |
| White with square black center..... | indicated cold wave.      |

The flag system has since been slightly modified; the latest flags adopted are shown in colors on the accompanying plate.

The distribution of weather information, special warnings, etc., for the benefit of the fruit interests in California was materially extended through the cooperation of the proprietor of the San Francisco Chronicle with the Western Union Telegraph Co., whereby the special warnings were sent throughout the raisin-growing districts during the wet season. The service was further extended by ordering the San Francisco office to telegraph the weather indications to four points or central stations in

Oregon, from which the information was further distributed.

The term "indications" which replaced "probabilities" in 1876, was changed to "forecasts" in 1889, since which time the latter term has been in use.

Previous to 1888 the observations on which the predictions of weather were based were taken three times a day—first at 7:30 a. m., 4:30 p. m., and 11:30 p. m.; afterwards at 7 a. m. and 3 and 10 p. m. On July 1, 1888, the hours of observation were changed to 8 a. m. and 8 p. m., seventy-fifth meridian time. During this year the number of places to which the forecasts were being telegraphed was 1,056. The change in the hours of observations necessitated a corresponding change in the distributing centers. As 70 per cent of the places receiving the forecasts could be better served by having the a. m. forecasts, the change from p. m. to a. m. forecasts was made to become effective on and after January 1, 1890.

During the year the use of "whistle signals" was begun. The system was modified somewhat, and the code of whistle signals now in use is as follows: A warning blast of from 15 to 20 seconds' duration is sounded to attract attention. After this warning the longer blasts (of from 4 to 6 seconds' duration) refer to weather, and shorter blasts (of from 1 to 3 seconds' duration) refer to temperature. Those for weather are sounded first:

#### Blasts:

|                  |                               |
|------------------|-------------------------------|
| One long.....    | indicates fair weather.       |
| Two long.....    | indicates rain or snow.       |
| Three long.....  | indicates local rain or snow. |
| One short.....   | indicates lower temperature.  |
| Two short.....   | indicates higher temperature. |
| Three short..... | indicates cold wave.          |

By repeating each combination a few times, with intervals of 10 seconds, liability to error in reading the signals may be avoided. The whistle signals met with favor for use at outlying places, but they are now used at only a few places.

The weather service branch of the Signal Corps, United States Army, was transferred to the Department of Agriculture on July 1, 1891. During this year "local forecast officials" were appointed, whose duty it was to supplement and amplify the forecasts made and sent out from Washington, D. C. This change was accompanied by a very large increase in the interest manifested by those who would be likely to receive benefit from a foreknowledge of the weather conditions. Closer attention was given to the dissemination of the forecasts and special warnings for the benefit of the agricultural classes and those living in the rural districts. The number of Weather Bureau stations at which the daily weather map was published was increased to 60. Forecasts were now being made for each of the States and Territories, and for from 24 to 48 hours in advance.

The distribution of the forecasts had been now extended so that on June 30, 1891, there were 630 places receiving forecasts for display of weather flags, 90 receiving cold-wave warnings, 51 frost warnings, and 6 in California receiving special warnings of rain. On September 30, 1891, the number of places where weather flags were displayed was further increased to 1,200, about 100 per cent over the number on June 30, 1891. In such cases the Government furnished the information, but the parties displaying the flags provided their own equipment, flagstaff and the flags.

A flag to indicate "local rain or snow" (see above, 1884) was adopted during the year and was put into use on July 1, 1892. It was a blue and white flag, divided horizontally, as shown by figure 3 of the accom-

panying plate. The system of flags now (1914) in use consists of the 8 shown in figures 1 to 17, inclusive.

The furnishing of weather flags by the Weather Bureau was begun by the purchase of 600 sets and supplied to the more important weather display stations. The telephone was used to a greater extent, and the forecasts were thereby made available to a larger number of people in the agricultural districts. The telephone was growing in popularity, and as the lines were extended into the rural districts advantage was taken of it by the Weather Bureau to extend its distribution of the forecasts. In many instances gratuitous distribution was allowed by the telephone companies, who claimed that the weather forecast feature of their telephone service increased its popularity.

On the Pacific coast the distribution of forecasts was further extended, and many expressed their appreciation of the forecast service and of its value to them in connection with their business. Over 100 specially selected places received the forecasts for distribution by telegraph in the Pacific Coast States, in Nevada and Utah.

Interest in the weather forecasts continued to grow, and then, as now, it was found impossible to comply with all the requests for them that were received. The Weather Bureau could authorize the telegraphing of the information only to the most important places where the recipient was so situated as to be able to disseminate it to others.

In the fall of 1894 the bureau put into operation a most valuable means of disseminating the forecasts—logotype forecast card—which soon attracted attention and became a very popular form of giving the information to the public.

The method, as still maintained, is to send the forecasts by telegraph to a central or distributing point, where the recipient sets up the forecasts in specially designed rubber type in a holder, and stamps by hand a number of cards sufficient to serve the town locally, and to supply all such near-by post offices as can receive the postal cards by 4 p. m. of the day on which they are issued.

The Secretary of Agriculture invited the Postmaster General's attention to the forecast card service and requested the cooperation of the Post Office Department. In the United States Postal Guide of June, 1895, was published a letter from the Postmaster General to postmasters inviting them to lend their aid in the prompt handling of the forecast cards.

The following statistics show the extent of the distribution of forecasts at the close of the fiscal year, June, 1895:

| AT GOVERNMENT EXPENSE.              |       |
|-------------------------------------|-------|
| Forecasts.....                      | 1,920 |
| Special warnings of cold waves..... | 198   |
| Special warnings of frost.....      | 419   |
| Emergency warnings.....             | 3,494 |

| FREE OF EXPENSE.             |        |
|------------------------------|--------|
| Mail forecast cards.....     | 11,732 |
| Telegraph and telephone..... | 1,239  |
| Railroad telegraph.....      | 2,348  |
| Railroad train service.....  | 1,218  |
| More than 22,000 daily.      |        |

Many of those interested in the forecasts expressed their opinions that the saving due to the cold-wave warnings alone was, at a conservative estimate, \$12,275,000 during 1895. This represents hardly 10 per cent of the value of all the property saved. The benefits and saving derived from the service largely exceeded its cost.

In 1896 forecast district centers were opened at Chicago, San Francisco, and Portland, Oreg., from which points also the Weather Bureau sent out the weather

forecasts. While there was a decrease in the number of places receiving forecasts at Government expense, the number of persons receiving the forecast card was increased more than 10,000.

From the very beginning of the forecast work in 1871 the daily press has contributed very greatly to the success that attended the bureau's efforts to effect a thorough distribution of the forecasts.

During the closing months of the year 1900 the Rural Free Delivery Service was utilized as a means of further extending the forecast distribution to the rural districts. Through the hearty cooperation of the Post Office Department it was possible for the bureau to serve 11,625 families on the rural delivery routes. The Chief of the Weather Bureau was prompt in taking advantage of this branch of the Government service to get the forecasts to those who formerly were unable to obtain them. To further facilitate the distribution of weather forecasts and to increase the usefulness of the Weather Bureau, three new forecast districts were inaugurated at this time: The New England district, with headquarters at Boston, Mass.; the West Gulf district, with headquarters at New Orleans, La.; the Rocky Mountain district, with headquarters at Denver, Colo.; by this new extension of the forecast districts the distribution of forecasts was further facilitated. During this year the number of families receiving forecasts by rural delivery was increased 42,000. The changes in the hours at which the rural carriers left on their routes caused a decrease in the number of families served by that means.

In July, 1902, the "wireless" telegraph was being used for the sending of weather forecasts and storm warnings to vessels at sea.

Next to the newspapers the telephone is and has been for a number of years the widest distributor of the weather forecasts. Special attention was given in 1906-7 to extending the distribution of forecasts by free telephone service. One hundred companies in the South Atlantic and Gulf States entered into cooperation with the Weather Bureau, extending the service to 72,500 subscribers. During the spring of 1907 various companies in the States of the Central Valleys began cooperating, and at the close of the fiscal year 1,655 telephone companies were cooperating in the work, representing about 2,000,000 subscribers, an increase during the year of 971,620. The small companies have a distinguishing "call" for the rural subscribers, when the forecast is sent over their wires as soon as received from the distributing center. Nearly all telephone companies had published in their directories a "notice" to the effect that the weather forecast could be obtained from their exchanges free after 11 a. m. daily.

The greatest number of places to receive forecasts at Government expense during any one year was 2,370. Special attention was given during the year 1910-11 to warnings for the benefit of growers and shippers of perishable products. This, "shippers' forecast card" has become quite popular in the mercantile districts. These cards contain the forecasts of probable temperatures likely to be encountered by perishable goods while in transit. Special attention has also been given to making forecasts of frost for the benefit of the fruit and cranberry interests.

The display of weather forecasts on moving-picture (cinematograph) screens is the latest method employed for giving the information to the public and was successfully begun in March, 1912. This means of forecast display is now used in eight cities.

## Weather and Storm Daytime Signals of the U. S. Weather Bureau.

Fig. 1.



Fair weather, stationary temperature.

Fig. 2.



Rain or snow, stationary temperature.

Fig. 3.



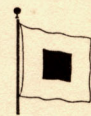
Local rain or snow, stationary temperature.

Fig. 4.



Temperature.

Fig. 5.



Cold wave.

Fig. 6.



Fair weather, warmer.

Fig. 7.



Fair weather, colder.

Fig. 8.



Rain or snow, warmer.

Fig. 9.



Rain or snow, colder.

Fig. 10.



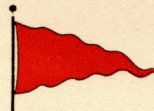
Local rain or snow, warmer.

Fig. 11.



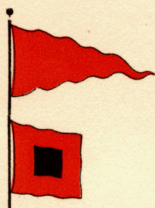
Local rain or snow, colder.

Fig. 12.



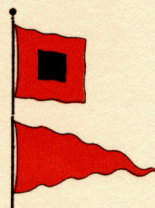
Small craft warning, moderately strong winds are expected.

Fig. 13.



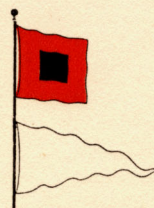
NE. storm winds.

Fig. 14.



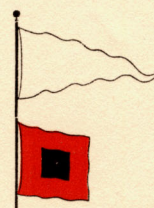
SE. storm winds.

Fig. 15.



SW. storm winds.

Fig. 16.



NW. storm winds.

Fig. 17.



Hurricane, or other severe, dangerous storm.

A red flag with black center indicates that a storm of marked violence is expected; the pennants indicate the direction of the winds. Red pennant, easterly; white, westerly; pennant above, northerly, and below, southerly.

From time to time since the beginning of the weather service in 1870 to the present, new methods for the distribution of forecasts have been tried, many have been abandoned as unsatisfactory or too expensive, and only those retained that assured improvement in placing the information before the public at the earliest possible moment and at the least expense.

The forecasts are now distributed by the daily newspapers, by telegraph, telephone, wireless telegraph, mail (including rural delivery), by display of flags, by whistle signals, and on moving-picture screens.

The following table shows approximately the present wide distribution of weather forecasts in the several States, exclusive of that made by newspapers, daily weather maps, by display of flags, and on moving-picture screens:

*Distribution of daily forecasts and special warnings.*

| State.                    | At Government expense.          |                        |                     | Without expense to Government by— |                 |            |                          |                      |
|---------------------------|---------------------------------|------------------------|---------------------|-----------------------------------|-----------------|------------|--------------------------|----------------------|
|                           | Forecasts and special warnings. | Special warnings only. | Emergency warnings. | Mail.                             | Rural delivery. | Telephone. | Rail-road train service. | Rail-road telegraph. |
| Alabama.....              | 24                              | 7                      | 136                 | 1,450                             | 337             | 43,907     | 0                        | 10                   |
| Arizona.....              | 8                               | 1                      | 0                   | 122                               | 0               | 4,661      | 0                        | 0                    |
| Arkansas.....             | 24                              | 9                      | 102                 | 845                               | 562             | 48,460     | 0                        | 11                   |
| California.....           | 84                              | 25                     | 10                  | 2,600                             | 54              | 0          | 0                        | 0                    |
| Colorado.....             | 9                               | 63                     | 41                  | 1,124                             | 1,080           | 84,300     | 0                        | 1                    |
| Connecticut.....          | 5                               | 0                      | 72                  | 2,116                             | 50              | 75,000     | 140                      | 0                    |
| Delaware.....             | 8                               | 1                      | 16                  | 150                               | 300             | 4,865      | 0                        | 27                   |
| District of Columbia..... | 0                               | 0                      | 0                   | 1,285                             | 0               | 20,000     | 0                        | 0                    |
| Florida.....              | 34                              | 107                    | 52                  | 1,367                             | 225             | 22,201     | 0                        | 240                  |
| Georgia.....              | 49                              | 32                     | 239                 | 1,835                             | 600             | 58,669     | 0                        | 161                  |
| Idaho.....                | 12                              | 0                      | 0                   | 285                               | 200             | 18,782     | 0                        | 0                    |
| Illinois.....             | 113                             | 47                     | 226                 | 3,135                             | 3,264           | 586,125    | 0                        | 1                    |
| Indiana.....              | 93                              | 2                      | 74                  | 2,659                             | 510             | 239,890    | 0                        | 0                    |
| Iowa.....                 | 139                             | 8                      | 455                 | 1,850                             | 2,057           | 243,059    | 0                        | 0                    |
| Kansas.....               | 92                              | 2                      | 175                 | 1,721                             | 785             | 136,383    | 0                        | 0                    |
| Kentucky.....             | 69                              | 32                     | 99                  | 1,773                             | 100             | 54,400     | 0                        | 0                    |
| Louisiana.....            | 76                              | 22                     | 48                  | 637                               | 0               | 32,136     | 0                        | 18                   |
| Maine.....                | 11                              | 1                      | 58                  | 1,190                             | 180             | 24,000     | 0                        | 0                    |
| Maryland.....             | 15                              | 49                     | 46                  | 2,248                             | 285             | 7,900      | 0                        | 281                  |
| Massachusetts.....        | 13                              | 13                     | 78                  | 3,158                             | 110             | 150,000    | 80                       | 0                    |
| Michigan.....             | 59                              | 1                      | 0                   | 4,680                             | 719             | 430,732    | 181                      | 407                  |
| Minnesota.....            | 73                              | 3                      | 171                 | 2,384                             | 1,839           | 159,599    | 0                        | 13                   |
| Mississippi.....          | 47                              | 7                      | 59                  | 1,361                             | 1,434           | 24,900     | 9                        | 6                    |
| Missouri.....             | 27                              | 2                      | 236                 | 5,539                             | 0               | 391,050    | 0                        | 1                    |
| Montana.....              | 12                              | 19                     | 13                  | 428                               | 0               | 19,500     | 0                        | 5                    |
| Nebraska.....             | 71                              | 9                      | 205                 | 2,188                             | 420             | 210,702    | 0                        | 0                    |

*Distribution of daily forecasts and special warnings—Continued.*

| State.              | At Government expense.          |                        |                     | Without expense to Government by— |                 |            |                          |                      |
|---------------------|---------------------------------|------------------------|---------------------|-----------------------------------|-----------------|------------|--------------------------|----------------------|
|                     | Forecasts and special warnings. | Special warnings only. | Emergency warnings. | Mail.                             | Rural delivery. | Telephone. | Rail-road train service. | Rail-road telegraph. |
| Nevada.....         | 5                               | 0                      | 0                   | 57                                | 0               | 1,200      | 0                        | 0                    |
| New Hampshire.....  | 15                              | 0                      | 44                  | 693                               | 775             | 14,080     | 15                       | 0                    |
| New Jersey.....     | 20                              | 17                     | 105                 | 1,484                             | 265             | 39,064     | 0                        | 179                  |
| New Mexico.....     | 8                               | 2                      | 0                   | 135                               | 0               | 10,500     | 0                        | 17                   |
| New York.....       | 109                             | 49                     | 409                 | 9,358                             | 661             | 735,352    | 0                        | 118                  |
| North Carolina..... | 60                              | 59                     | 187                 | 1,310                             | 1,500           | 35,00      | 0                        | 0                    |
| North Dakota.....   | 25                              | 3                      | 93                  | 500                               | 1,800           | 15,000     | 0                        | 150                  |
| Ohio.....           | 70                              | 147                    | 237                 | 7,291                             | 323             | 450,000    | 0                        | 0                    |
| Oklahoma.....       | 30                              | 1                      | 0                   | 680                               | 343             | 3,965      | 0                        | 160                  |
| Oregon.....         | 10                              | 7                      | 0                   | 492                               | 218             | 13,000     | 0                        | 0                    |
| Pennsylvania.....   | 76                              | 42                     | 315                 | 6,475                             | 1,393           | 491,700    | 0                        | 452                  |
| Rhode Island.....   | 1                               | 0                      | 14                  | 221                               | 0               | 2,560      | 13                       | 0                    |
| South Carolina..... | 32                              | 11                     | 105                 | 935                               | 375             | 33,378     | 0                        | 39                   |
| South Dakota.....   | 51                              | 9                      | 70                  | 875                               | 7               | 46,000     | 0                        | 2                    |
| Tennessee.....      | 47                              | 3                      | 222                 | 1,867                             | 2,863           | 65,741     | 0                        | 0                    |
| Texas.....          | 85                              | 65                     | 227                 | 1,347                             | 773             | 201,305    | 0                        | 0                    |
| Utah.....           | 6                               | 26                     | 0                   | 212                               | 325             | 34,106     | 1                        | 0                    |
| Vermont.....        | 12                              | 0                      | 54                  | 906                               | 425             | 22,475     | 12                       | 0                    |
| Virginia.....       | 58                              | 6                      | 84                  | 1,790                             | 1,797           | 26,882     | 0                        | 44                   |
| Washington.....     | 22                              | 21                     | 0                   | 847                               | 400             | 3,551      | 0                        | 0                    |
| West Virginia.....  | 34                              | 8                      | 55                  | 994                               | 0               | 50,069     | 0                        | 0                    |
| Wisconsin.....      | 106                             | 6                      | 309                 | 2,653                             | 1,184           | 67,330     | 0                        | 0                    |
| Wyoming.....        | 12                              | 2                      | 13                  | 320                               | 0               | 6,935      | 0                        | 0                    |
| Totals.....         | 2,059                           | 946                    | 5,154               | 89,512                            | 30,538          | 5,462,212  | 451                      | 2,343                |

Owing to the limited funds available for the purpose the extension of the forecast distribution during recent years has been smaller than it might have been could advantage have been taken of all of the many opportunities that from time to time were presented. The greatest extension has been made through the free distribution by telephone, and it has been by this means that the distribution has been maintained without impairment.

The Weather Bureau has ever been alert to take advantage of every opportunity tending to the betterment of forecast distribution, and is to-day making the forecasts available to more than 5½ million persons, exclusive of those supplied through the daily newspapers, daily weather maps, display of flags, and on moving-picture screens.